THURSDAY, AUGUST 8, 1907.

RESEARCH IN CHINA.

Research in China. In three volumes and Atlas: vol. i. in 2 parts. Part i. *Descriptive Topography and Geology.* By Bailey Willis, Eliot Blackwelder, and R. H. Sargent. Pp. xiv.+354+xvi. (Washington, D.C.; Published by the Carnegie Institution, 1907.)

THE title of this volume recalls the great pioneer work of the illustrious Baron von Richthofen, to whom science is indebted for the first broad and masterly sketch of the physiography and geology of the Celestial Empire. His volumes, unfortunately left still incomplete at the time of his lamented death, form the basis on which all later explorers will build. He indicated some of the great problems which remain to be solved by a more prolonged and minute survey than it was in his own power to achieve. But even where he left questions in doubt, his trained powers of observation sometimes enabled him to see so far into them, and to leave so many pregnant suggestions concerning them, that the paths for subsequent exploration have been indicated by him to his successors.

One of these paths lay in the further investigation of the great series of ancient sedimentary deposits, to which Richthofen gave the name of "Sinisches" (Sinesian or Sinian) system. He collected from what he regarded as the higher parts of this system a number of fossils, which proved the strata containing them to be of Cambrian age. As these sedimentary accumulations appeared to be thousands of feet in thickness, they seemed to offer at least a possibility that, in their lower members, traces might be found of a still older or pre-Cambrian fauna. The great interest which would attach to the discovery of any recognisable remains of that primæval biological period had long drawn the attention of geologists to the desirability of following up the suggestive observations of the German explorer. The opportunity of undertaking this investigation came at last when the Carnegie Institution of Washington was founded in 1902, with ample funds for the purposes of scientific research of every kind in all quarters of the globe. Mr. C. D. Walcott, then the energetic Director of the United States Geological Survey, whose contributions to Cambrian palæontology have given him a world-wide reputation, suggested the sending out of an expedition to China, one of the objects of which should be the further elucidation of the fossil contents of the oldest Palæozoic rocks of the country. He succeeded in planning and organising a scientific mission for the purpose of investigating the stratigraphy, palæontology, structure, and physiography of the regions to be visited. The first grant was made by the Carnegie Institution in the autumn of the year 1902, but it was not until July of the following year that the mission sailed for Europe. The party consisted of two geologists, Mr. Bailey Willis, an active member of the staff of the United States Geological Survey, to whom the chief charge of the expedition was assigned, and Mr. Eliot Blackwelder, of the University of Chicago. They were subsequently joined in China by Mr. R. Harvey Sargent, of the United States Geological Survey, who acted as topographer, and produced the series of maps which forms the Atlas.

The observers reached Pekin late in September, 1903, and spent about two months of the autumn of that year in the geological investigation of certain parts of the province of Shan-tung. The first five and a half months of 1904 were devoted to the exploration of Central China, and the journey of investigation came to an end at I-chang, on the Yang-tzi-kiang, on June 9. The time occupied by the research was thus little more than seven months in all. During this brief period the party must have worked hard. Their topographical surveys by graphic plane-table triangulation went on at an average rate of nearly fifty square miles a day, and an area of 2,900 square miles was mapped in fifty-eight days and a half. While the topographer was thus active, the geologists were simultaneously busy with their observations and collections. The results of this combined labour are intended to fill three massive volumes and an atlas of maps. The first part of the first volume which, with the Atlas, has just been issued, forms a bulky quarto of more than 350 pages, with upwards of fifty plates, consisting of photographic views of landscapes, maps, and geological sections. The second part is to include systematic petrography, zoological notes, and a syllabary of Chinese sounds. The second volume is intended "to summarize the detailed presentation of our results, and to combine them with the work of others in a systematic discussion of the geology of south-eastern Asia." The third volume is to be devoted to Palæontology. The Atlas contains some forty sheets of maps, sections, and photographic views, most of the maps being on the scale of 1/125,000, or two miles to the inch, engraved and coloured in the excellent style to which the United States Geological Survey has now accustomed us.

We willingly record our appreciation of the energy, skill, and success with which this expedition has been conducted. But we feel sure that the question will be asked by many not unsympathetic onlookers—were the few months of rapid and necessarily imperfect and incomplete observation sufficient to justify the addition of all these volumes to the ever-growing mass of geological literature? It has long been a characteristic of American geological explorers that they cannot simply describe what they have seen, but must launch out into theoretical disquisitions and systematic discussions, for which there has often been but slender basis in their own work. The various pioneering and other surveys have thus built up a pile of huge quartos, in which the really valuable original observations are often practically buried out of sight. The books are heavy alike for the hand and the head. They take up a large amount of space on library shelves, where they are now, we fear, comparatively seldom consulted.

The volume now before us is a conspicuous illustration of the American habit here referred to. We venture to think that all that was new and important among the results of the expedition might easily have

been comprised within the limits of this first single volume. Not content, however, with the space the observers have contrived to fill with the amplification of their notes and discussions of the physiography of the regions which they rapidly traversed, and of which they can have acquired only the most superficial knowledge, Mr. Bailey Willis is yet to inflict upon us another volume of his "detailed presentation of results," besides the other reports that are promised.

If it is asked what have been the chief fruits of this skilfully-planned foray into the Chinese empire, two conspicuous features may be pointed to, on which the explorers deserve to be congratulated. They have materially increased our knowledge of the earliest Palæozoic fauna of China, and they have brought to light a remarkable band of boulder-clay, full of striated stones, lying apparently at the base of the Cambrian system.

The large increase which has thus been made to the known Cambrian fossils of China has been provisionally discussed by Mr. Walcott in a paper published in 1905, in the Proceedings of the United States National Museum, and will be more fully treated in the third volume of the Reports of the Expedition. It appears that at least forty-eight genera and 172 species of organisms are now known to occur in Chinese Cambrian formations, the greater number being assigned by Mr. Walcott to the middle division of the system. The lower division has yielded comparatively few forms, and it does not appear that any trace has been recovered of a fauna older than Cambrian. The trilobitic representation is especially abundant, comprising 118 species, belonging to twenty-five genera. The full details respecting this primæval fauna will be awaited with much interest.

It would appear from the observations of Messrs. Bailey Willis, and Blackwelder that Richthofen perhaps over-estimated the thickness of his "Sinisches System," and that the chances of the recovery of a pre-Cambrian fauna were less than had been hoped for. In Shan-tung the total thickness seems to be little more than 4000 feet, of which only some 1500 or 1600 feet are relegated to the Cambrian system, the overlying strata being referred to the next member of the Geological Record. The lower Cambrian division, consisting of 500 or 600 feet of shales and thin limestones, rests unconformably on a set of gneisses, schists, and granite, with other eruptive rocks. Mr. Blackwelder made a reconnaissance, in the Liau-tung peninsula, nearly along Richthofen's route; but he was unable to add anything of importance to what was noted by the German explorer regarding the Cambrian rocks of that district.

In threading the gorges of the Yang-tzi, the expedition at Nan-t'ou found at the base of the Palæozoic series a remarkable group of sediments resting unconformably on granite-gneiss, and having a total thickness of about 370 feet. Above a conglomerate and a series of red and white sandstones lies a mass of hard green boulder-clay or till, some 200 feet thick, which can be seen to dip under the Ki-sin-ling limestone. No fossils were obtained by the travellers from this boulder-clay, nor after a search for two hours were any found by them in the overlying bands of limestone. But as they disinterred Lower and Middle Cambrian organisms from what they regarded as the same limestone within less than 100 miles from Nan-t'ou, they regard it as highly probable that this ancient boulder-clay is of early Cambrian age.

The stones are subangular, with rounded edges and well-polished and well-striated surfaces. They are of various kinds of rock, and of all sizes up to two feet and a half in length, and they are huddled together without order, as in ordinary boulder-clay. The specimens represented in plate xxxviii. might have been selected as typical examples from any Pleistocene boulder-clay of Europe or America. It is hardly possible to resist the evidence that here is a true glacial deposit which, whether or not intercalated at the very base of the Cambrian system of China, must almost certainly be of early Palæozoic date.

The physiographical discussions in the volume are most unsatisfactory. When one reflects how difficult are the problems of physiographical development, how much patient research is needed into the geological history of a region, how much detailed local topographical knowledge is absolutely essential, and how little, after all, dogmatism on the subject is permissible, one is amazed at the confidence with which the physiography of vast territories is here disposed of. It is not by surveys of fifty square miles a day that these problems are to be solved, and it is matter for regret that such jejune attempts should be made, and should find a place in what ought to be a serious contribution to science.

THE EXPLORATION OF TIBET.

Tibet, the Mysterious. By Sir Thomas Holdich, K.C.M.G., K.C.I.E. Pp. ix + 356; illustrated. (London: Alston Rivers, Ltd., 1906.) Price 7*s.* 6*d.* net.

"THE public which concerns itself about Tibet is a very small public indeed," says Sir Thomas Holdich in the volume he has compiled for "The Story of Exploration" series, and to this we may add that public interest in that country is not likely to be increased by such unsympathetic treatment as the subject receives in this book. The story of geographical achievement in Tibet, and especially of the attempts to reach the jealously guarded capital of the then closed land, was for many years one of the most fascinating interest, and now in the light of the more precise information that has recently been made available it could well afford re-telling as an instructive record of great daring and tenacity of purpose. In professing to supply such a summary, however, the present account is disappointing in that its information is neither very trustworthy nor up-to-date. The author does not appear to have any personal knowledge of the country, nor has he made himself sufficiently acquainted with what has been written on the subject, with the result that his book betrays frequent inaccuracies, and a lack of clear perspective that is rather bewildering to the reader. The narrative is made up for the most part of quotations from the reports of the more or less illiterate native sur-